REMARKS

Claims 1-51 are currently pending. New claims 47-51 have been added. Claims 1-3, 5, 8, 12, 15-19, 21, 24, 28, 30-32, 34, 37, 41, 43 and 45 have been amended for readability and/or to remove extraneous language, and these claim changes are not intended to relate to patentability or to narrow the scope of the claims. Claim 17 has also been amended to divide the subject matter recited therein between two claims (claim 17 and new claim 48), and this change is not intended to affect the claim scope. Claim 31 has also been amended to delete subject matter already recited in claim 32, and this change is not intended to affect the claim scope. In addition, Figure 7 is proposed to be amended to make a correction to the horizontal axis labeling that is readily apparent from at least the discussion at page 26, line 18 – page 27, line 2 of the application.

The Office Action includes a rejection of claims 1-4, 8-20, 24-33 and 37-40 under 35 U.S.C. § 103(a) as allegedly being unpatentable over the Winkler et al. publication (U.S. Patent Application Publication No. 2002/0053638) in view of the Takashima patent (U.S. Patent No. 5,731,586). This rejection is respectfully traversed.

Claim 1 recites an objective lens for an electron microscopy system with magnetic and electrostatic focusing for inspecting an object positionable in an object plane, comprising, among other features, a pole shoe arrangement having an inner pole shoe and an outer pole shoe and having a pole shoe gap between the inner and outer pole shoes at a lowermost position in the z-direction of the inner pole shoe, a coil body disposed in a space between the inner and the outer pole shoes, and an electrode arrangement for generating a focusing electrostatic field comprising a

beam tube and a terminal electrode disposed spaced apart from the lower end of the beam tube. Among other recited features, claim 1 recites that the objective lens is configured to allow a working distance between the terminal electrode and the object plane that is smaller than 2 mm for electrons which pass through the beam tube at energies of about 30 keV, and that conditions $30° < \alpha < 35°$ and $10° < \Delta - \chi < 14°$ apply wherein α represents the outer cone angle of the outer pole shoe, Δ represents the inner cone angle of the outer pole shoe, and χ represents the outer cone angle of the inner pole shoe.

The Office suggests that the Winkler et al. publication discloses an objective lens having all of the features recited in claim 1 except for an outer cone angle of the outer pole shoe between 30° and 35° and an inner cone angle between 10° and14°. In this regard the Office misstates the claim language, which actually recites that the difference between angles Δ and χ is between 10° and 14°. In addition, the Office alleges that the Takashima patent discloses an objective lens with an outer cone angle of 30° (citing column 1, lines 55-65 and column 2, lines 52-63) and an inherent inner cone angle of about 14°. The Office suggests it would have been obvious to modify the Winkler objective lens to use the small cone angle of the Takashima objective lens to provide a high-resolution, magnetic-electrostatic lens to result in a beam that is scanned obliquely over the sample surface. Applicants respectfully disagree with the Office's assessment.

It is respectfully submitted that the rejection does not make out a *prima facie* case of obviousness. The Winkler et al. publication is directed to a modification of an apparatus for examining a specimen with a beam of charged particles, wherein charging of the specimen is avoided/reduced by injecting inert gas onto the

specimen surface (Abstract). Contrary to the Office's suggestion, the Winkler et al. patent does not disclose in paragraphs 38 or 39 (or elsewhere) that the objective lens disclosed therein is configured to allow a working distance of less than 2 mm beyond a terminal electrode of the objective lens. If the Office is referring to the reference electrode 15 disclosed at paragraph 41 as allegedly corresponding to the claimed terminal electrode in this regard, such correspondence is inappropriate. The reference electrode 15 disclosed at paragraph 41 in the Winkler et al. publication is not part of the objective lens disclosed therein. Rather, the reference electrode 15 is an additional electrode disposed between the specimen 3 and the lower electrode 13 of the objective lens which is connected to a gas conduit 14, which serves to inject gas onto the sample surface (paragraph 41).

It is noted that Figure 8 of the Winkler publication discloses an embodiment wherein the gas conduit is integrated into the objective lens. However, there is no disclosure of a working distance of less than 2 mm in connection with that embodiment. Thus, in either case, the Winkler et al. publication does not disclose the claimed working distance.

In addition, it is respectfully submitted that the working distance recited in claim 1 in combination with other recited features is unobvious. Claim 1 specifies, for example, that the objective lens is configured to allow a working distance of less than 2 mm for electrons which pass through the beam tube at energies of about 30 keV in connection with an outer cone angle between 30 and 35 degrees. The small cone angle advantageously can allow examination of a specimen at a high tilt angle, i.e., up to 60 degrees. The Winkler publication, however, is silent with regard to electron energies and, as noted by the Office, does not disclose the cone angle

limitations recited in claim 1. One of ordinary skill in the art would readily understand that operating a conventional objective lens of the type disclosed in Figure 1 of the Winkler et al. publication at primary beam energy of 30 keV would conventionally preclude a short working distance of less than 2 mm, particularly with the claimed cone angle limitations. Accordingly, the claimed working distance is not disclosed by the Winkler et al. publication, nor is it obvious in view thereof. The Takashima patent does not make up for this deficiency of the Winkler et al. publication inasmuch as the accelerating voltages disclosed in the Takashima patent range only up to 15 kV (see Figure 4 and column 3, lines 27-48 therein).

In addition, as noted above, the Office has misstated the claim language with regard the another angular range recited in claim 1. In particular, the Office alleges that the Takashima patent inherently discloses an inherent inner cone angle of about 14°. However, claim 1 actually recites that the difference between angles Δ and χ is between 10° and14°, wherein Δ represents the inner cone angle of the outer pole shoe, and χ represents the outer cone angle of the inner pole shoe. It is respectfully submitted that neither the Winkler et al. publication nor the Takashima patent disclose this subject matter.

Further, contrary to the Office's suggestion, the Takashima patent does not disclose an outer cone angle of an outer pole shoe between 30 and 35 degrees for a lens of the configuration recited in claim 1. The Office first cites column 1, lines 55-65 as allegedly disclosing this subject matter, but this section pertains to Figure 1 of the Takashima patent, which is directed to a different type of lens design that does not have both inner and outer pole shoes. Rather, the lens illustrated in Figure 1 of the Takashima patent has a coil 2 wound around a bobbin 1, with a yoke 3 (a single

pole piece) at an outer surface of the coil 2. As such, Figure 1 of the Takashima patent is inapplicable to the subject matter at hand, and the Office's reliance on it is misplaced.

Further, contrary to the Office's suggestion, column 2, lines 52-63 of the Takashima patent does not disclose an outer cone angle of an outer pole shoe between 30 and 35 degrees for a lens of the configuration recited in claim 1. This section of the Takashima patent pertains to Figure 3 therein, which illustrates a lens having inner and outer pole pieces (referred to as bottom and top pole pieces, respectively). However, the cited section does not disclose that the lens illustrated in Figure 3 has an outer cone angle of 30 degrees. In fact, column 2, lines 37-47 of the Takashima patent disclose that the Figure 3 lens can only achieve a tilt angle of up to about 50 degrees, i.e., the outer cone angle is not less than about 40 degrees. At lines 45-47, it is stated that the tilt angle of 50 degrees is insufficient and that a tilt angle of 60 degrees is desired. But this latter statement merely reflects a desired goal, not a characteristic of the Figure 3 lens.

In fact, the Takashima patent states at column 2, line 48 – column 3, line 9, that it is impossible to design the Figure 3 lens to have a tilt angle of 60 degrees for four reasons set forth therein. In other words, Takashima was of the opinion that it would be impossible to redesign an lens of the type illustrated in Figure 3 therein (which corresponds to the lens illustrated in Figure 1 of the Winkler publication, but without the gas conduit arrangement) to have an outer cone angle of 30 degrees. Takashima therefore took a completely different approach and arrived at a lens design illustrated in Figure 5 therein that utilizes a single pole piece (see also column 5, lines 42 et seq.). The Takashima patent indicates at column 2, lines 1-9 therein

that the lens illustrated in Figure 3 of the Takashima patent is disclosed in the Frosien et al. article ("Compound magnetic and electrostatic lenses for low-voltage applications", J. Vac. Sci. Technol. B 7(8), Nov./Dec. 1989). The Frosien et al. article has been reviewed, and no information was observed therein that would tend to contradict Takashima's analysis of the lens illustrated in Figure 3 of the Takashima patent.[1]

Thus, the Takashima patent not only fails to disclose an outer cone angle of between 30 and 35 degrees as recited in claim 1, but also provides exceedingly strong evidence of the non-obviousness of the subject matter recited in claim 1. One of ordinary skill in the art reading the Takashima patent would not have been motivated to attempt to modify the Winkler et al. device to have a cone angle of 30 degrees given the statement in the Takashima patent that it would be impossible to redesign such a device to have a tilt angle of 60 degrees. If anything, one of ordinary skill in the art reading the Winkler et al. publication and the Takashima patent might have been inclined to modify the Takashima Figure 5 device, which has a single pole shoe, to have a gas conduit as disclosed in the Winkler et al. publication.

Accordingly, for at least the above-noted reasons, it is respectfully submitted that claim 1 is patentable over the Winkler et al. publication in view of the Takashima patent. Withdrawal of the rejection against claim 1 and allowance of the same are respectfully requested. Claims 2-14 and 41-42 are allowable at least by virtue of dependency.

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[1] A copy of the Frosien et al. article is attached hereto along with a PTO-1449 form listing the same for the Examiner's convenience.

Independent claims 15 and 31 are patentable over the Winkler et al. publication and the Takashima patent at least for reasons similar to those set forth above. For example, as discussed above, one of ordinary skill in the art would not have been motivated to combine the disclosures of the Winkler et al. publication and the Takashima patent to arrive at a lens design having both inner and outer pole shoes. If anything, one of ordinary skill in the art reading the Winkler et al. publication and the Takashima patent might have been inclined to modify the Takashima Figure 5 device, which has a single pole shoe, to have a gas conduit as disclosed in the Winkler et al. publication. One of ordinary skill in the art would not have been motivated to attempt the modification suggested by the Office. The rejection should be withdrawn for at least this reason.

In addition, claim 15 recites additional subject matter not disclosed in either the Winkler et al. publication or the Takashima patent. Claim 15 recites, among other features, that the terminal electrode is magnetically coupled to the outer pole shoe with a gap therebetween, for reducing the magnetic field in the object plane. As shown in the example of Figure 4 of the present application, for instance, the terminal electrode 114 is separated from the outer pole shoe 112 by a small gap wherein the terminal electrode 114 and the outer pole shoe have vertical surface portions that oppose each other at this gap. Such an exemplary gap configuration provides a low magnetic resistance path that effectively channels magnetic flux between the terminal electrode 114 (which can be made of Mumetal, for example) and the outer pole shoe 112, thereby reducing the magnetic field strength at the object plane. Of course, the claims are not intended to be limited to the example shown in Figure 4.

In contrast, the lens configurations of Figure 1 of the Winkler et al. publication and Figure 3 of the Takashima patent do not possess a low magnetic resistance path between a terminal electrode and an outer pole shoe. Rather, those lens designs, which are illustrated in more detail in the prior art Figure 1 of the present application, are understood to have a configuration in which the terminal electrode opposes the outer pole shoe across a gap that occurs between points of the terminal electrode and the outer pole shoe. Such a configuration presents a high magnetic resistance path, which results in a substantial magnetic field density being present at the object plane. Accordingly, claim 15 is further patentable for at least this additional reason. Claims 16-30 and 43-44 are allowable at least by virtue of dependency.

Claim 31 also recites additional subject matter that is not obvious in view of the Winkler et al. publication and the Takashima patent. Claim 31 recites, among other features, that a distance between the lowermost position in the z-direction of the inner pole shoe and the lower end of the beam tube is larger than 9 mm. In contrast, neither the Winkler et al. publication nor the Takashima patent disclose this subject matter or provide any suggestion for arriving at it.

In addition, it is believed that one of ordinary skill in the art would not have been motivated to modify the Winkler et al. Figure 1 device to possess the above-noted feature of claim 31 because it appears that doing so would render that device unsuitable for its intended purpose. In particular, the Figure 1 device disclosed in the Winkler et al. patent has a reference electrode 15 arranged with a gas conduit 14 to reduce charging at the sample surface, to establish a predetermined potential at that region of the sample surface, and/or to extract secondary electrons from the sample

surface. The actual dimensions are not disclosed in the Winkler et al. publication, but it appears that extending the lower end of the Winkler et al. beam tube/upper electrode 12 more than 9 mm beyond the lower surface of the inner pole piece 8 would likely interfere at least electrically, and perhaps structurally, with the reference electrode 15, thereby altering the characteristics of the electric field in the vicinity in the reference electrode from the desired state. Modifying the Winkler et al. Figure 1 device to have the beam tube/upper electrode 12 protrude below the outer pole shoe 9 (such as recited in claim 34) would appear to be even more problematic for similar reasons. Accordingly, claim 31 is further patentable for at least this additional reason. Claims 32-40 and 45-46 are allowable at least by virtue of dependency.

Page 3 of the Office Action contains a suggestion that the subject matter recited in dependent claims 3, 4, 8, 12, 14, 17, 19, 20, 24, 29-33, 37 and 40 would have been obvious allegedly because modifying pole piece dimensions and electrode dimensions as routine optimization of result effective variables would have lead to the claimed subject matter. Presumably, the Office is making this statement in connection with the Office's main suggestion of modifying the Winkler et al. device to have a cone angle of 30 degrees as allegedly disclosed in the Takashima patent. To the contrary, as noted above, the Takashima patent contains a statement that redesigning the instrument illustrated in Figure 3 (which is like the lens illustrated in Figure 1 of the Winkler et al. publication) therein to have tilt angle of 60 degrees (i.e., a cone angle of 30 degrees) would be impossible for several reasons. Accordingly, in view of this disclosure, it cannot be said that further modifying the Winkler et al. device to achieve the subject matter recited in claims 3, 4, 8, 12, 14, 17, 19, 20, 24, 29-33, 37 and 40 would result from routine optimization.

Further, the Office's statement with regard to such optimization is too broad and undefined to support such a rejection. For example, exactly what property or characteristic is hypothetically being optimized by changing the dimensions of the pole pieces and electrodes? The Office has provided no such explanation, and its statement in this regard is facially overbroad. The rejection should be withdrawn for at least this additional reason.

The Office Action includes additional obviousness rejections of dependent claims 5, 21, and 34, claims 6, 7, 22, 23, 35 and 36, and claims 41-46 as set forth in paragraphs 3-5 therein, in view of the Winkler et al. publication and the Takashima patent, and further in view of the Frosien patent (U.S. Patent No. 4, 926,054), the Allen et al. patent (U.S. Patent No. 5,623,183), and the Takane et al. publication (U.S. Patent Application Publication No. 2003/0010914). These rejections are respectfully traversed at least because the Office's reliance on these additional references does not make up for the deficiencies of the Winkler et al. publication and the Takashima patent as described above. In addition, for example, the Takane et al. publication discloses that the method of obtaining three dimensional information described therein in the context of electron microscopy can also be applied to a focused ion beam apparatus. But this is not a disclosure of combining an electron microscope apparatus with a focused ion beam apparatus as recited in claims 41-46. Accordingly, that rejection is further deficient for at least this reason. Thus, dependent claims 5, 21, 34, 6, 7, 22, 23, 35, 36, and 41-46 are allowable over the applied references for at least these reasons and by virtue of dependency.

New claims 47-51 have been added herein to round out the scope of protection sought. These claims are allowable over the applied references at least for reasons similar to those set forth above.

In light of the above, withdrawal of the rejections and allowance of this application are respectfully requested. Should there be any questions in connection with this application, the Office is invited to contact the undersigned at the number below.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

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By: Douglas H. Pearson

Douglas H. Pearson
Registration No. 47,851

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620

Annotated Marked Up Drawing

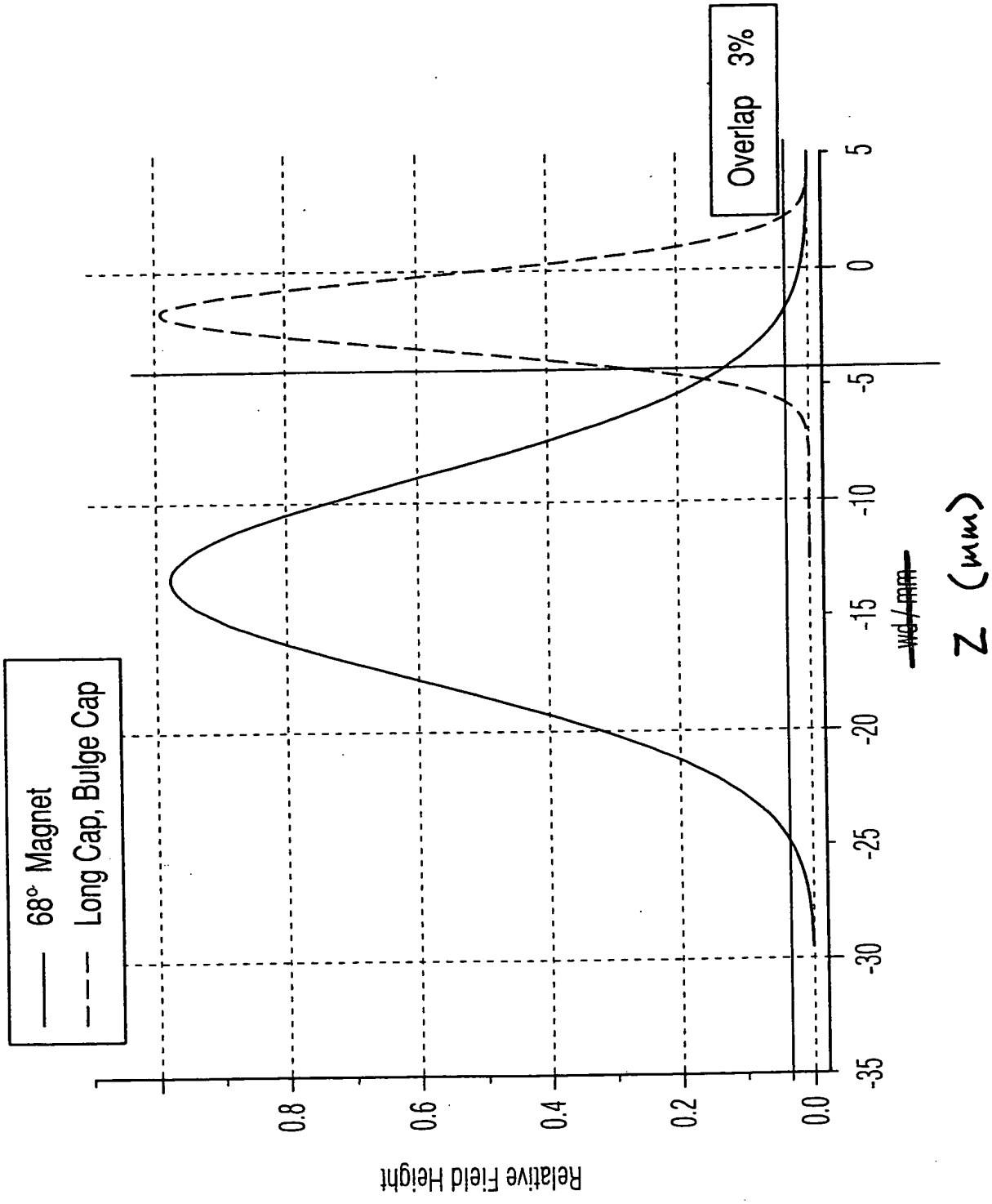

Fig. 7